IN the September number of the *Bulletin de la Société d'Encouragement pour l'Industrie Nationale*, N. S. Kournakow gives an account of his investigations on the alloys formed by sodium and potassium with mercury and of sodium with cadmium, lead and bismuth. The method employed was the determination of the temperature of fusion. Curves are drawn representing the variation of the temperature of fusion with the composition, and in all cases these curves are characterised by very distinct temperature maxima. In the case of the combination sodium and mercury, no less than seventy-five experiments have been carried out, each with a different proportion of the components. The maxima of temperature referred to are remarkably high—346° C. in the case of sodium and mercury, and 269·7° C. in the case of potassium and mercury, and the composition of the alloy corresponding to these temperatures is exactly represented by the formulæ $NaHg_2$ and KHg_2. The freezing-point depression curves which proceed from these temperature maxima are shown to extend through large temperature intervals. In the case of $NaHg_2$ the curve extends from 346° C. to 218° C. on addition of sodium, and to 155° C. on addition of mercury. The combinations of sodium with cadmium, lead and bismuth are also distinguished by very high temperature maxima, these being respectively 395°, 420° and 720° C., whereas the melting-points of the pure metals are Na 96°, Cd 322°, Pb 326°, and Bi 268° C. These characteristic temperatures correspond exactly with the formulæ $NaCd_2$, Na_2Pb, and Na_3Bi. The author draws attention to the similar phenomena which have been observed with the combinations—aluminium and gold, aluminium and antimony—and concludes that in these latter the aluminium functions as an alkali metal, giving rise to the same peculiarities as sodium and potassium in the alloys investigated by himself.

IN Prof. Cook Wilson's letter on the formula of inverse probability (p. 154) the following corrections should be made, though they do no not affect the fundamental argument: In line four of letter, for C_r and P_r read C_n and P_n; in line six, for p_r read p_n; p. 155, col. 2, line 13, for "in reality" read "on reality"; in penultimate paragraph, the last word, "strong," should be "strongest"; and in the eighth line from end, "the head" should read "this head." Finally, Prof. Wilson wishes $\frac{p_r P_r x}{\Sigma pP}$ (line 19, col. 1, p. 155) to read $\frac{p_r P_r x}{\Sigma pPx} = \frac{p_r P_r}{\Sigma pP}$.

FROM Mr. W. Engelmann, Leipzig (London: Williams and Norgate), the following scientific works have been received:—The third edition of A. de Bary's "Vorlesungen über Bakterien," revised and partly rewritten by Prof. W. Migula; Part i. of "Studien über die Verbreitungsmittel der Pflanzen," by Dr. M. Kronfeld, dealing with fertilisation effected by wind; and two parts of "Das Pflanzenreich," a conspectus of the vegetable kingdom, edited by Prof. A. Engler under the auspices of the Prussian Imperial Academy of Sciences. The plants described in these parts belong to the Musaceæ, Typhaceæ and Sparganiaceæ.

THE additions to the Zoological Society's Gardens during the past week include a Chimpanzee (*Anthropopithecus troglodytes*, ♀) from West Africa, presented by Captain W. G. Ambrose; a Mozambique Monkey (*Cercopithecus pygerythrus*) from East Africa, presented by Mr. W. J. Langton; a Lesser White-nosed Monkey (*Cercopithecus petaurista*) from West Africa, presented by Miss L. Harold; a Stair's Monkey (*Cercopithecus stairsi*, ♂) from the Lower Zambesi, presented by Miss J. C. S. Purves; a Green Monkey (*Cercopithecus callitrichus*) from West Africa, presented by Miss M. A. Reeve; a Duke of Bedford's Deer (*Cervus xanthopygius*, ♀) from Manchuria, presented by H.G. the Duke of Bedford; a Suricate (*Suricata tetradactyla*) from South Africa, presented by Captain F. E. Cannot, A.S.C.; a Spur-winged Goose (*Plectropterus gambensis*) from West Africa, presented by H.E. Colonel F. Cardew, C.M.G.; a Common Heron (*Ardea cinerea*), two Mediterranean Peregrine Falcons (*Falco punicus*) from Mogador, presented by Mr. W. T. Barneby; a Kinkajou (*Cercoleptes caudivolvulus*) from South America, a Blue-bonnet Parrakeet (*Psephotus haematorhous*) from Australia, an Eupatorian Parrakeet (*Palaeornis eupatria*) from India, a Patagonian Conure (*Cyanolyseus patagonus*) from La Plata, three Caspian Terrapins (*Clemmys caspica*) from Western Asia, deposited; two Black-tailed Parrakeets (*Polytelis melanura*) from Australia, purchased.

OUR ASTRONOMICAL COLUMN.

NEW VARIABLE IN CYGNUS.—Mr. A. Stanley Williams announces in the *Astronomische Nachrichten*, Bd. 154, No. 3675, the detection of a new variable star. Its position is

$$\left.\begin{array}{l}\text{R.A.} = 20\text{h. } 59\text{m. } 50\text{s.}\\ \text{Decl.} = +28^\circ\ 49'{\cdot}6\end{array}\right\}(1855{\cdot}0).$$

The magnitudes were obtained from measurements of photographs obtained with a Grubb 4·4 inch portrait lens, and were as follows:—

1899.	Oct. 6	...	Mag.	= 9·85
	9	...		= 9·85
1900.	26	...		= 11·0
	Nov. 15	..		= 11·4
	22 (hazy)			= 11·4±.

In the same journal Prof. Kreutz gives a list bringing together all the new variables discovered during the past year.

SPANISH OBSERVATIONS OF THE ECLIPSE OF MAY 28.—A preliminary report of the observations of the total eclipse of the sun, May 28, made at Plasencia by the official party of Spanish astronomers, has just been issued by Señor Iniguez, director of the Madrid Observatory. The principal objects of the expedition were to record the times of the four contacts, to obtain photographs of the corona, and to determine the position of the green line of the coronal spectrum. The attendant phenomena, however, were not neglected. Among the larger instruments employed were an equatorial refractor of 20 centimetres aperture and 3 metres focus, a photographic equatorial of 20 centimetres aperture and 2 metres focus, a photographic telescope of 16 centimetres aperture and 1 metre focus, and a six prism visual spectroscope worked in conjunction with a cœlostat and horizontal telescope. The weather conditions were excellent, and a very graphic account of the general work of the expedition and of the eclipse itself is given. Five excellent photographs of the corona were obtained, three with the larger and two with the smaller coronagraph. It is remarked that the principal prominences were unconnected with the coronal extensions, and that in one of the photographs the streamers can be traced to a distance of about three diameters. For the green coronal line a wave-length of 5297·3 was determined, as compared with Sir Norman Lockyer's 5303·7 and Prof. Campbell's 5303·26 obtained from the photographs of 1898. Shadow bands were seen a minute and a half before totality, lying in a direction from south-west to north-east and travelling from north-west to south-east with a velocity comparable with that of a man walking, and at a distance apart of 8 centimetres. The atmosphere was so clear that the moon's disc was seen projected on the background of the corona for two minutes after the last contact. During the eclipse the thermometer in the shade fell 4° and that in the sun 8°. An interesting series of photographs is reproduced to show the reduction of light at various phases of the eclipse, and copies of the corona pictures are also included in the report. Señor Iniguez, to whom many foreign astronomers were indebted for much valuable information relating to their expeditions, is to be warmly congratulated on the admirable results of the efforts of his own party.

OPPOSITION OF EROS.—A sixth circular has been issued by M. Loewy from the Paris Observatory, containing ephemerides of 81 fundamental stars selected from the region including the trajectory of Eros during the period 1900 September–December,

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intended for use in the reduction of meridian measures of the planet. The positions for 77 of these are given at intervals of 10 days, and for the remaining four polar stars daily positions.

Two other observatories have undertaken the special task of determining the co-ordinates of stars for reference—Charkow, directed by M. L. Struve, and d'Abbadia, directed by M. l'Abbé Verschaffel.

Many notices have come to hand indicating that a considerable number of successful determinations have been made, and a scheme is being considered to ensure the publication of all the combined results in such form as to be of the greatest service to the observers, and thus any one may be able to have access to the complete data.

M. de Campos Rodrigues, director of the Lisbon Observatory, writes saying that 743 observations have been made; heliometric measures have been commenced at Bamberg, by M. Hartwig; at the Observatory at Algiers 63 photographs have been taken.

Both at Paris and Algiers it has been found that an exposure of six minutes is sufficient to record stars as faint as 12·5 magnitude, and from special trials it is considered that with this exposure it is certain that a sufficient number of comparison stars will be obtained surrounding the planet. Prof. Hale has forwarded the times of observation at which Prof. Barnard has taken micrometer measures with the 40-inch Yerkes telescope, and a comparison shows that several of these, made during the first part of the night, correspond almost directly with others obtained at European observatories (Paris and Cambridge) during the second part of the night.

A letter from Prof. Comstock is also included, giving particulars for the accurate determination of the diurnal motion.

MARKING ON MARS.—A Circular received from the *Centralstelle* at Kiel announces a message from Prof. Pickering, who on December 8 received a telegram from Mr. Douglass, of the Lowell Observatory, Flagstaff, Arizona, stating that he had observed a projection on the northern edge of the Icarium Mare which remained visible for seventy minutes.

SPECTROSCOPIC INVESTIGATIONS OF GASES IN ATMOSPHERIC AIR.[1]

IN August last some tubes were filled at low pressure by an improved process with the more volatile gases of the atmosphere.[2] The air was liquefied directly from that above the roof of the Royal Institution by contact at atmospheric pressure with the walls of a vessel cooled below − 200° C. When about 200 c.c. of liquid had condensed, communication with the outer air was closed by a stop-cock. Subsequently communication was opened, through another stop-cock, with a second vessel cooled by immersion in liquid hydrogen, and a part of the liquid from the first vessel, maintained at − 210°, was allowed to distil into the second still colder vessel. When about 10 c.c. had condensed in the solid form in the second vessel, communication with the first vessel was cut off, and a manometer showed a pressure of gas of about 10 to 15 mm. of mercury.

This mixture of gases was passed into tubes previously exhausted by a mercury pump, but before reaching the tubes it had to pass through a U-tube immersed in liquid hydrogen so as to condense less volatile gases, such as argon, nitrogen, oxygen or carbonic oxide, which might be carried along by those more volatile. Previous trials with tubes filled in the same way, except that the U-tube in liquid hydrogen was omitted, showed that these tubes contained traces of nitrogen, argon and compounds of carbon. The tubes filled with gas which had passed through the U tube showed on sparking no spectrum of any of these last-mentioned gases, but showed the spectra of hydrogen, helium and neon brilliantly, as well as a great many less brilliant rays of unknown origin. In addition, they showed at first the brightest rays of mercury, derived no doubt from the mercury pump by which they had been exhausted before the admission of the gases from the liquefied air. After some sparking the mercury rays disappeared, probably in consequence of absorption of the mercury by the electrodes, which were of aluminium.

In one experiment the mixture of gases in the second vessel, into which a fraction of the liquefied air was distilled as above described, was pumped out without being passed through the U-tube in liquid hydrogen and examined. This mixture was found to contain 43 per cent. of hydrogen, 6 per cent. of oxygen, and 51 per cent. of other gases—nitrogen, argon, neon, helium, &c.—and it was explosive when mixed with more oxygen. This shows conclusively that hydrogen in sensible proportion exists in the earth's atmosphere, and if the earth cannot retain hydrogen or originate it then there must be a continued accession of hydrogen to the atmosphere (from interplanetary space), and we can hardly resist the conclusion that a similar transfer of other gases also must take place. The tubes containing the residue of atmospheric gases uncondensed at the temperature of liquid hydrogen we have examined spectroscopically.

On passing electric discharges through them, without any condenser in the circuit, they glow with a bright orange light, not only in the capillary part, but also at the poles, and at the negative pole in particular. The spectroscope shows that this light consists in the visible part of the spectrum chiefly of a succession of strong rays in the red, orange, and yellow, attributed to hydrogen, helium and neon. Besides these, a vast number of rays, generally less brilliant, are distributed through the whole length of the visible spectrum. They are obscured in the spectrum of the capillary part of the tube by the greater strength of the second spectrum of hydrogen, but are easily seen in the spectrum of the negative pole, which does not include the second spectrum of hydrogen, or only faint traces of it. Putting a Leyden jar in the circuit, while it more or less completely obliterates the second spectrum of hydrogen, also has a similar effect on the greater part of these other rays of, as yet, unknown origin. The violet and ultra-violet part of the spectrum seems to rival in strength that of the red and yellow rays, if we may judge of it by the intensity of its impressions on photographic plates. We were surprised to find how vivid these impressions are up to a wave-length 314, notwithstanding the opacity of glass for rays in that part of the spectrum. The photographs were taken with a quartz calcite train, but the rays had to pass through the glass of the tube containing the gases.

We have made approximate measurements of the wave-lengths of all the rays which are sufficiently strong to be seen easily or photographed with an exposure of thirty minutes, and give a list of them below. These wave-lengths are computed to Rowland's scale, and were deduced from the deviations produced by two prisms of white flint glass for the visible, and of calcite for the invisible, rays. The wave-lengths assigned to the helium lines are those given by Runge and Paschen, and some of these lines were used as lines of reference. In general, the iron spark spectrum was the standard of reference.

The tubes when first examined showed the lines of the first spectrum of hydrogen vividly, and the earlier photographs of the spectrum of the negative pole contained not only the violet lines of hydrogen, but also the ultra-violet series as far up as λ 337. In order to get impressions of the faintest rays, exposures of half an hour or more were required, and a succession of photographs had to be taken so as to get different sections of the spectrum into the middle of the field, where measurement of the deviations would not be impeded by the double refraction of the calc spar. As the light of the negative pole only was required, the electric discharge was made continuously in one direction only, with the result that the hydrogen lines grew fainter in each successive photograph, and soon disappeared altogether. Along with the ultra-violet rays, the less refrangible rays of hydrogen also disappeared, so that no trace of the C or F line could be seen, nor yet of the second spectrum, so long as the current passed in the same direction as before. Reversal of the current soon made the F line show again, so that it seems that the whole of the hydrogen was driven by the current to the positive pole. The conditions under which this ultra-violet series shows itself are a matter of interest. It appears here in the midst of a brilliant spectrum due to gases other than hydrogen, and yet it is very difficult to obtain a photograph of it when no gas but hydrogen is known to be present, or, at least, to become luminous in the electric discharge.

We have had an opportunity of comparing the spectrum of the volatile residue of air with that of the more volatile part of gas from the Bath spring. The tube did not admit of the separate examination of the light from the negative pole, but

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[1] "On the Spectrum of the more Volatile Gases of Atmospheric Air, which are not Condensed at the Temperature of Liquid Hydrogen." Preliminary notice by Prof. G. D. Liveing and Prof. Dewar.—Read before the Royal Society on December 13.

[2] In this paper we describe researches in continuation of those previously communicated to the Society by one of us, in a paper entitled "Application of Liquid Hydrogen to the Production of High Vacua, together with their spectroscopic Examination." *Roy. Soc. Proc.* vol. 64, p. 231.

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